REMARKS

Claim 1 is rewritten as claim 29 and more particularly points out that Applicants' planar oxygen sensor includes a ground plane electrode that is adapted for temperature measurement and comprises a first lead (20 in Fig. 1), a second lead (22) and a temperature sensing portion (18) electrically interconnecting the first lead and the second lead and having an electrical resistance indicative of temperature, see paragraph 0015. In accordance with the claim, at least said first lead is disposed between the gas sensing arrangement and the heating device and is electrically connected to the first heating device lead, as shown in Fig. 1. Further, the claim calls for the first lead to have a surface area greater than the temperature sensing portion and an electrical resistance less than the electrical resistance of the temperature sensing portion. Still further, the claim calls for a ground terminal (12) connected to the first lead of the ground plane electrode and the first heating device lead, a resistance measurement terminal (14) connected to the second lead of the ground plane electrode, and a power terminal (16) connected to the second heating device lead, see paragraph 0015. In accordance with the claim, the ground terminal and the resistance measurement terminal are adapted to be connected to an electrical circuit for measuring the electrical resistance, which electrical resistance is indicative of temperature, and further the power terminal and said ground terminal are adapted to be connected to a power source for providing electrical current to the heating device.

Claim 30 is dependent upon claim 29 and further calls for an isolation layer

disposed between the ground plane electrode and the heating device, e.g., layer 30 in Fig. 1.

Claim 31 is dependent upon claim 29 and further calls for a temperature measurement device comprising an electrical circuit connected to the ground terminal and the resistance measurement terminal, see Fig. 6 and paragraph 0021.

Claim 32 is dependent upon claim 31 and further recites that the temperature measurement device includes a first capacitor connected to the ground terminal and a second capacitor connected to the resistance measurement terminal, see Fig. 6 and paragraph 0021.

Claim 32 is dependent upon claim 31 and further recites that the temperature measurement device includes an AC signal source, see Fig 6 and paragraph 0021.

Claim 19 is rewritten as claim 34 and is directed to the method of Applicants' invention that includes providing a ground plane electrode having the features recited in claim 1. The claim further calls for connecting a temperature measurement device to the first lead and the second lead of the ground plane electrode to measure an electrical resistance therebetween, which electrical resistance is indicative of the temperature of said planar oxygen sensor.

Claims 35, 36 and 37 are dependent upon claim 34 and further recite features similar to claims 30, 32 and 33.

Claim Rejection under 35 USC § 103

The claims were rejected under 35 U.S.C. § 103 as unpatentable over the Admitted Prior Art in view of United States Patent No. 5,989,398, issued to Young et al.; United States Patent No. 4,417,470, issued to McCracken et al.; and United States Patent No. 5,562,811, issued to Lenfers in 1996.

The rejection points to the Admitted Prior Art described in the Background of the application. In an oxygen sensor, it is known to arrange a pump cell, reference cell and sensor chamber. It is also know to provide a heater to raise the temperature of the sensor to a preferred range. It is also known to provide a ground plane to isolate the electrodes of the cells from the electromagnetic noise created by the electrical current to the heater. In Applicants' invention, the ground plane is designed also to measure the temperature of the sensor. For this purpose, the ground plane includes leads that have a large surface area to provide the desired shielding of the heater device. The leads are connected by a thin portion, referred to as the temperature sensing portion, which exhibits a significant change in resistance as a function of temperature. Thus, the temperature of the sensor may be determined by measuring the resistance of the ground plane.

The prior art, including the three references cited in the rejection, does not teach or suggest an oxygen gas sensor having a ground plane configured to measure temperature, as in Applicants' invention.

Young et al. describes a sensor for detecting hydrocarbon species that includes

heaters 50a, 50b, and 58 and thermometers 46a and 46b, col. 6, lines 21-23. The rejection points to ground plane 54. However, the ground plane is separate and distinct from the thermometers 46a and 46b. Attention is directed to the vias 68 in Fig. 3 that connect the several elements to the terminals for purposes of making external electrical connections. The connection to the ground plane 54 is through the center set of vias. Heaters 58 and 62 are connected through the outboard sets of vias, whereas the intermediate vias between the center set and the outboard sets are used for connections to the thermometers. Thus, the ground plane is not connected to the leads of the heaters or the thermometers. In contrast, in Applicants' oxygen sensor, the ground plane is adapted for measuring temperature. For this purpose, the ground plane includes a temperature sensing portion between first and second leads. The connection to the ground plane in Young et al. is suitable for grounding, but is not adapted for measuring electrical resistance, and so Young et al. does not point to measuring the electrical resistance of the ground plane to indicate temperature. Moreover, the ground plane in Applicants' sensor includes a lead, referred to as the first lead, which is connected to a lead of the heating device, referred to as the first heating device lead. Young et al. provides separate terminals for the connections to the thermometers and the ground plane. Thus, at least for these reasons, Young et al. does not point to Applicants' invention.

McCracken et al. describes a temperature sensor, but does not include heating circuit or other circuitry, such the circuitry for gas detection in Applicants' sensor. Thus, McCracken et al. does not need or include a ground plane, and so does not show a ground

plane adapted to measure temperature, key features of Applicants' invention.

Lenfers describes an oxygen sensor that is readily distinguished from Applicants' invention. First, Lenfers determines sensor temperature by measuring the electrical resistance of the electrodes of the pump and reference cells, see beginning at col. 3, line 60. Second, in Lenfers, heating element 44 is separated form electrode 30 only by insulating layer 42, col. 3, lines 20-34. That is, the sensor does not include a ground plane shielding the sensor electrodes from the heater. Thus, Lenfers does not show a ground plane adapted to measure temperature, as in Applicants' invention.

Thus, even when combined, the references do not lead to Applicants' invention. In the Admitted Prior Art, the ground plane and temperature sensor are separate and distinct elements. Young et al. also shows a ground plane separate from the thermometers. McCracken et al. and Lenfers do not provide ground planes. Thus, even when considered together, there is nothing to point the practitioner to adapt the ground plane that shields the heating element, so as to carry out the additional function of temperature measurement, so as to arrive at Applicants' invention.

Claim 29 is directed to a planar oxygen sensor having a ground plane that is adapted for temperature measurement. In the Admitted Prior Art, and also in Young et al., the ground plane and the temperature measuring element are distinct. Lenfers and McCracken et al. do not provide a ground plane. As set forth in the claim, the ground plane in Applicants' sensor includes a temperature sensing portion that interconnects the

first and second leads and has an electrical resistance indicative of temperature. Further, the first lead of the ground plane is disposed between the heater and the gas sensing arrangement of the sensor, is connected to the first heating device lead of the heating device, has a surface area greater than the temperature sensing portion and has an electrical resistance less than the temperature sensing portion. None of the references show a sensor having a ground plane with these features to adapt the ground plane for measuring temperature. Thus, the Admitted Prior Art and the references do not lead the practitioner to Applicants' sensor in claim 29.

Claims 30-33 are dependent upon claim 29 and so not taught or suggested by the prior art for the reasons set forth with regard to that claim.

Claim 34 is directed the Applicants' method for measuring a temperature in a planar oxygen sensor and calls for providing and measuring an electrical resistance of a ground plane electrode having the features of the ground plane in claim 29. For the reasons herein, the prior art does not show a ground plane adapted for measuring an electrical resistance indicative of temperature, and so does not show the method in claim 34, or claims 35-37 dependent thereon.

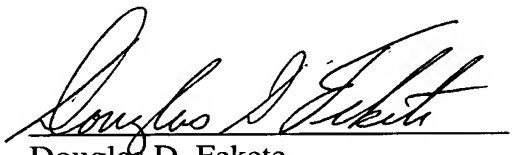
Accordingly, it is respectfully requested that the rejection of the claims based upon the Admitted Prior Art, Young et al., Lenfers, and McCracken et al. be reconsidered and withdrawn, and that the claims be allowed.

Conclusion

It is believed, in view of the rewritten claims and remarks herein, that all grounds of rejection of the claims have been addressed and overcome, and that all claims are in condition for allowance. If it would further prosecution of the application, the Examiner is urged to contact the undersigned at the phone number provided.

The Commissioner is hereby authorized to charge any fees associated with this communication to Deposit Account No. 50-0831.

Respectfully submitted,



Douglas D. Fekete
Reg. No. 29,065
Delphi Technologies, Inc.
Legal Staff – M/C 480-410-202
P.O. Box 5052
Troy, Michigan 48007-5052

(248) 813-1210